

WLAN-3G Interworking Architectures

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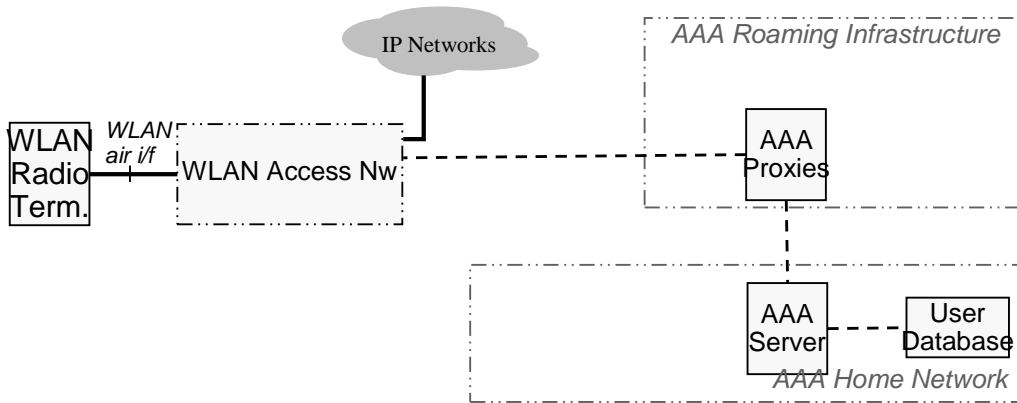
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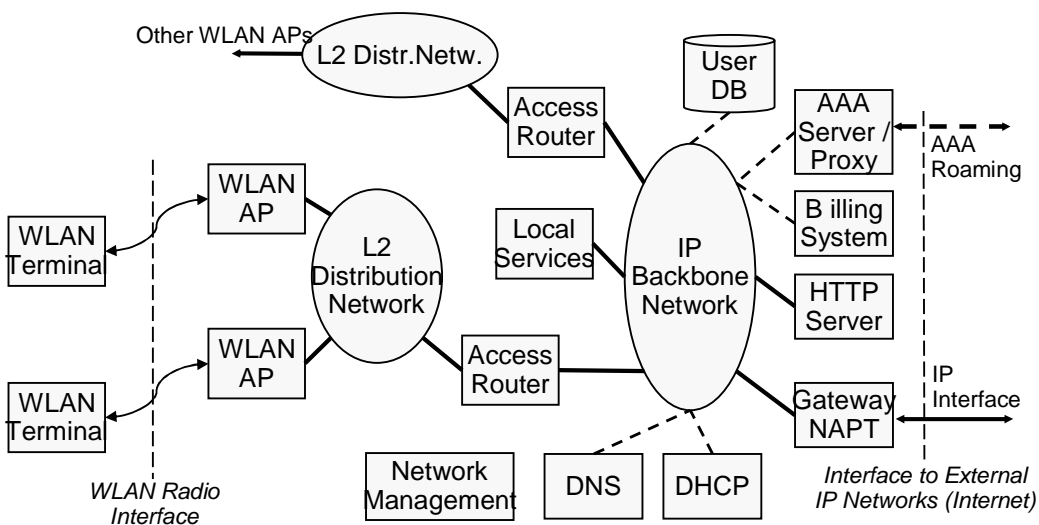
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Defacto WLAN system



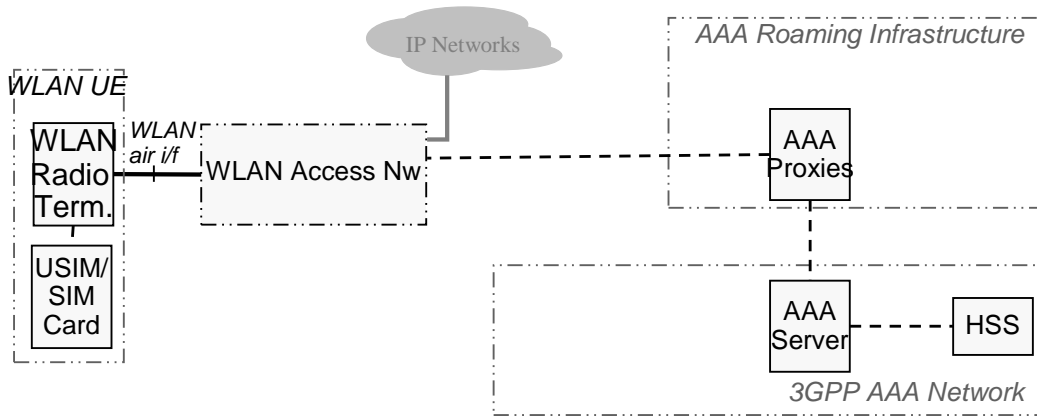
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Defacto WLAN, Internal Structure



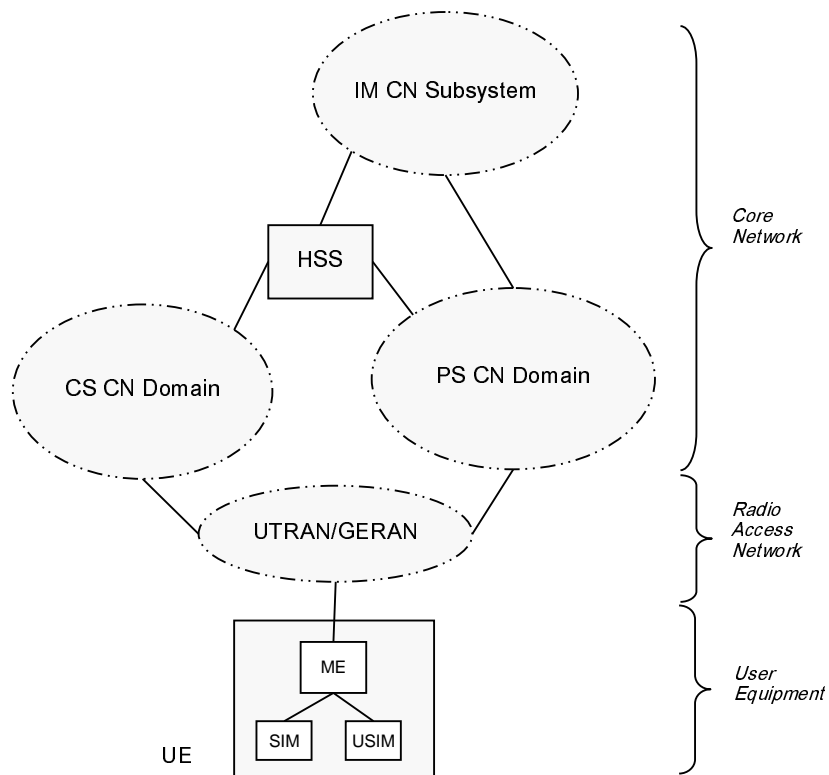
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3GPP Subscription



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3GPP System



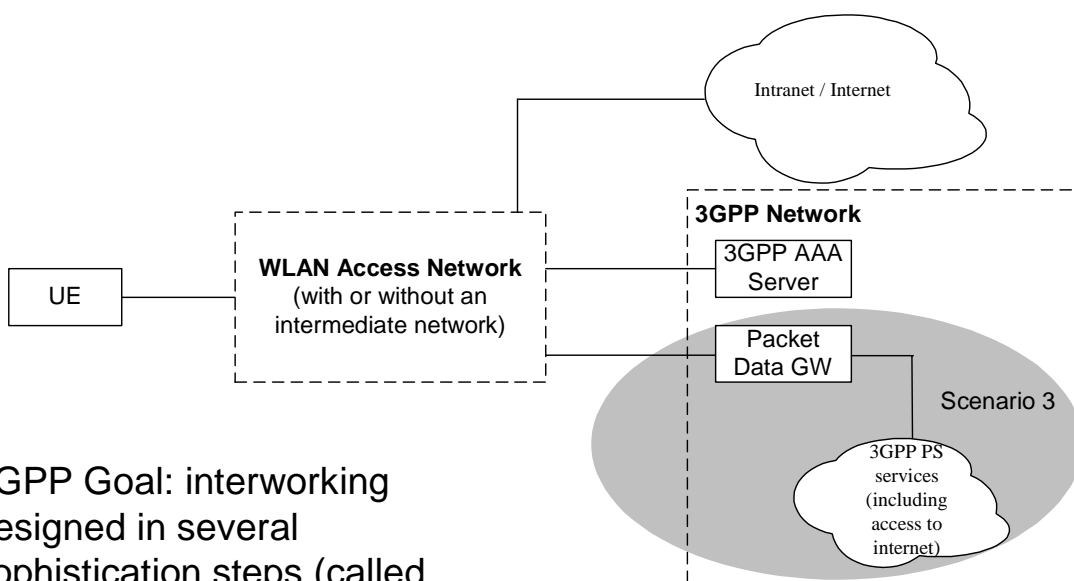
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Why Interworking WLAN?

- * WLAN devices are becoming commodity
- * Performance in data rates well beyond any current or near-future cellular access
- * PWLAN - “Cheap” access perception (if on top of existing transport to premises)
- * Coverage where it is needed – lounges, conf. centers, cafes, hang-around places....
- * WISPs springing up and going bankrupt (no working business model has been discovered to date)
- * Cellular operators and PWLAN:
 - Fear factor: reacting to WISP – better to lose revenue to own branch than to WISPs (just in case they would succeed)
 - New business factor: see it as a means for generating new revenue from access and services
- * There is the need to offer PWLAN access solutions for CellOps:
 - Vendor-interoperable standardized solution (in the telecom sense)
 - Roaming solution
 - Exclusive and sophisticated solution (living in the monopoly telecom world)
 - Solution reusing current networking gear, business support systems, and operations support systems.
- * Ideal body for standardization: 3GPP with GSMA ironing out the usage

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Interworking WLAN Architecture Standard in 3GPP



3GPP Goal: interworking designed in several sophistication steps (called *scenarios*) independent of WLAN

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Interworking WLAN Architecture Standard in 3GPP: Scenarios

•3GPP SA1 has devised 6 “scenarios”

Scenarios:	Scenario 1: Common Billing and Customer Care	Scenario 2: 3GPP system based Access Control and Charging	Scenario 3: Access to 3GPP system PS based services	Scenario 4: Service continuity	Scenario 5: Seamless services	Scenario 6: Access to 3GPP system CS based Services
Service and operational Capabilities:						
Common billing	X	X	X	X	X	X
Common customer care	X	X	X	X	X	X
3GPP system based Access Control		X	X	X	X	X
3GPP system based Access Charging		X	X	X	X	X
Access to 3GPP system PS based services from WLAN			X	X	X	X
Service Continuity				X	X	X
Seamless Service Continuity					X	X
Access to 3GPP system CS based Services with seamless mobility						X

Focus in 3GPP R6 (red box around Scenarios 3, 4, 5)

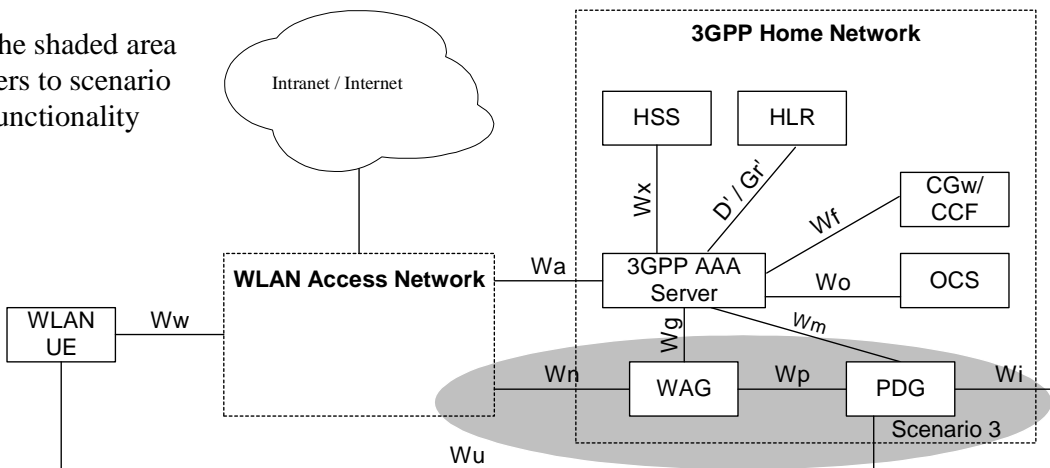
No purpose found by 3GPP SA1 (blue box around Scenario 6)

Out of scope for 3GPP (green box around Scenario 1)

Focus in 3GPP R7 (yellow box around Scenario 3)

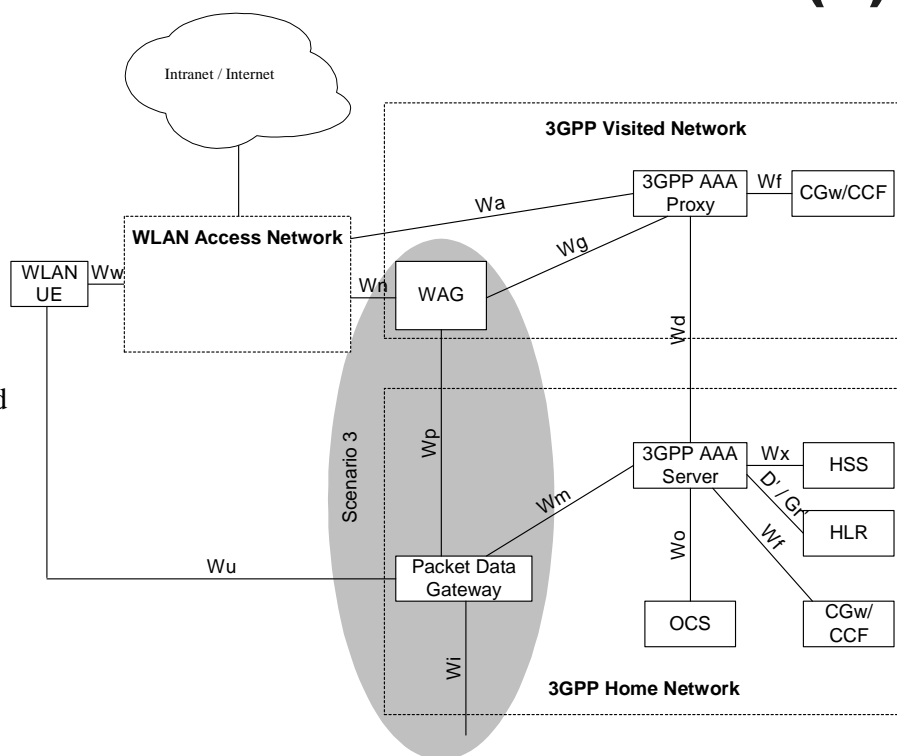
Non Roaming WLAN Inter-working Architecture Reference Model

• The shaded area refers to scenario 3 functionality



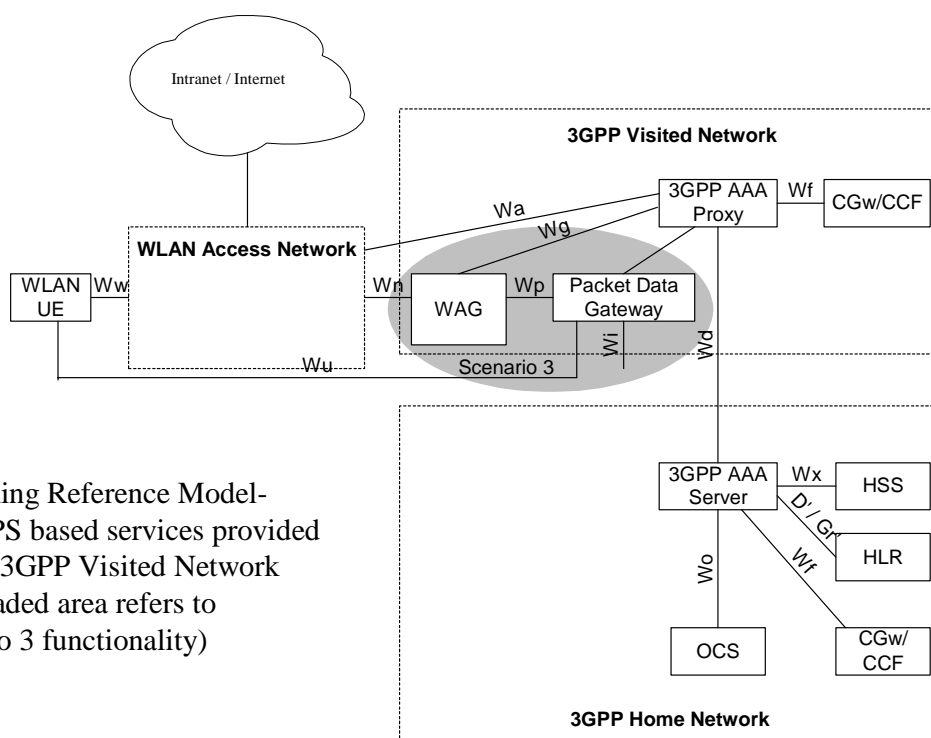
Roaming WLAN Inter-working Architecture Reference Model (a)

• Roaming Reference Model- 3GPP PS based services provided via the 3GPP Home Network (the shaded area refers to scenario 3 functionality)



Roaming WLAN Inter-working Architecture Reference Model (b)

• Roaming Reference Model- 3GPP PS based services provided via the 3GPP Visited Network (the shaded area refers to scenario 3 functionality)



WLAN UE

- * According to its capability, a WLAN UE is categorized into three classes (WA, WB,WC), functions:
 - Associating to an I-WLAN.
 - WLAN access authentication based on EAP methods.
 - Selection of a suitable VPLMN in the roaming case.
 - Building an appropriate NAI.
 - Obtain a local IP address.
 - Building an appropriate W-APN to be used in scenario 3.
 - Request the resolution of a W-APN in scenario 3 to a PDG address.
 - Establish a secure tunnel in scenario 3 to a PDG.
 - Obtain a remote IP address to be used in scenario 3.
 - Accessing services provided in the operators PS domain.

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3GPP AAA Proxy

- * The 3GPP AAA Proxy represents a proxying and filtering function that resides in the Visited 3GPP Network. Functions:
 - Relaying the AAA information between WLAN and the 3GPP AAA Server.
 - Enforcing policies derived from roaming agreements between 3GPP operators and between WLAN operator and 3GPP operator
 - Reporting per-user charging/accounting information to the VPLMN CCF/CGw for roaming users
 - Service termination (O&M initiated termination from visited network operator)
 - Protocol conversion when the Wa and Wd reference points do not use the same protocol

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3GPP AAA Server

- * The 3GPP AAA server is located within the 3GPP network. The 3GPP AAA Server:
 - Retrieves authentication information and subscriber profile (including subscriber's authorization information) from the HLR/HSS of the 3GPP subscriber's home 3GPP network.
 - Authenticates the 3GPP subscriber based on the authentication information retrieved from HLR/HSS. The authentication signaling may pass through AAA proxies.
 - Communicates authorization information to the WLAN potentially via AAA proxies.
 - Registers its (the 3GPP AAA server) address or name with the HLR/HSS for each authenticated and authorized 3GPP subscriber.
 - Initiates the Purge procedure when the 3GPP AAA server deletes the information of a subscriber.
 - May act also as a AAA proxy (see above).
 - Maintains the WLAN UE's WLAN-attach status.
 - Provides the WLAN UE's WLAN-attach status to other entities (which are out of the scope of this TS).
 - Generates and reports per-user charging/accounting information to the HPLMN CCF/CGw.

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HLR/HSS

- * The HLR/HSS located within the 3GPP subscriber's home network is the entity containing authentication and subscription data required for the 3GPP subscriber to access the WLAN interworking service.

- * The HSS also provides access to the WLAN UE's WLAN-attach status for other entities, e.g. answers or relays the WLAN-attach status query from other entities.

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WLAN Access Gateway

- * The WLAN Access Gateway is a gateway via which the data to/from the WLAN Access Network shall be routed via a PLMN to provide a WLAN UE with 3G PS based services in scenario 3.
 - Allows VPLMN to generate charging information for users accessing via the WLAN AN in the roaming case.
 - Enforces routing of packets through the PDG.
 - Performs collection of per tunnel accounting information, e.g. volume count (byte count) and elapsed time, to be used for inter-operator settlements.
 - Filters out packets based on unencrypted information in the packets. Packets should only be forwarded if they

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Packet Data Gateway

- * 3GPP PS based services (Scenario 3) are accessed via a Packet Data Gateway.
 - Contains routing information for WLAN-3G connected users;
 - Routes the packet data received from/sent to the PDN to/from the WLAN-3G connected user;
 - Performs address translation and mapping;
 - Performs de-capsulation and encapsulation;
 - Allows allocation of the WLAN UE's remote IP address;
 - Relays the WLAN UE's remote IP address allocated by an external IP network to the WLAN UE, when external IP network address allocation is used.
 - Performs registration of the WLAN UE's local IP address and binding of this address with the WLAN UE's remote IP address;
 - Provides procedures for unbinding a WLAN UE's local IP address with the WLAN UE's remote IP address;
 - Provides procedures for authentication and prevention of hijacking (i.e. ensuring the validity of the WLAN UE initiating any binding of the WLAN UE's local IP address with the WLAN UE's remote IP address, unbinding etc.)
 - May filter out unauthorized or unsolicited traffic with packet filtering functions. All types of message screening are left to the operators' control, e.g. by use of Internet firewalls.
 - Generates per user charging information.

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Interworking reference points

- * Wa: Reference point between a WLAN Access Network and a 3GPP AAA Server/Proxy (charging and control signalling)
 - To transport authentication, authorization and charging-related information in a secure manner.
- * Wx: Reference point between an HSS and a 3GPP AAA Server
 - Communication between WLAN AAA infrastructure and HSS.
- * D'/Gr': Reference point between a pre-R6 HSS/HLR and a 3GPP AAA Server
 - Communication between WLAN AAA infrastructure and HLR
- * Wo: Reference point between a 3GPP AAA Server and an OCS
 - To transport online charging related information so as to perform credit
- * Wf: Reference point between a CGw/CCF and a 3GPP AAA Server/Proxy
 - To transport/forward charging information towards 3GPP operator's Charging Gateway/Charging collection function located in the visited network or home network where the subscriber is residing.
- * Wg: Reference point between a 3GPP AAA Proxy and WAG
 - Used by WAG to perform policy enforcement functions for authorised users.
- * (Cont.)

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Interworking reference points

- * (Cont.)
- * Wp: Reference point between a WLAN Access Gateway and a Packet Data Gateway
- * Wn: Reference point between a WLAN Access Network and a WLAN Access Gateway
 - To force traffic on a WLAN UE initiated tunnel to travel via the WAG.
- * Wi: Reference point between a Packet Data Gateway and an external IP Network
 - globally addressable for UE, similar to Gi interface.
- * Wm: Reference point between a Packet Data Gateway and a 3GPP AAA Server
 - Carrying messages for service authentication.
- * Wd: Reference point between a 3GPP AAA Proxy and a 3GPP AAA Server (charging and control signalling)
 - To transport authentication, authorization and related information in a secure manner.
- * Wu: Reference point between a WLAN UE and a Packet Data Gateway
 - WLAN UE-initiated tunnel establishment and release

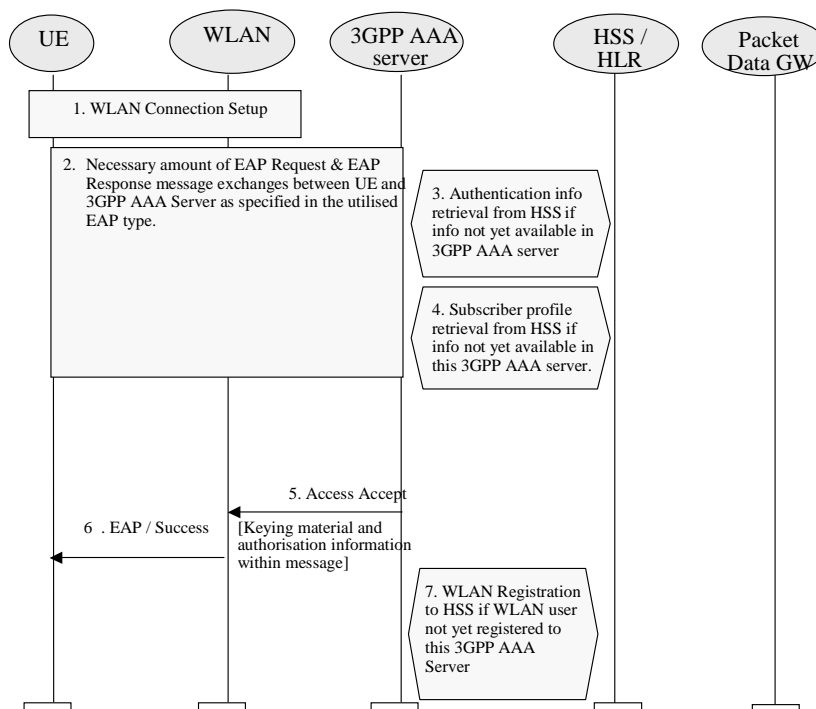
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WLAN Access Authentication and Authorisation (1)

- * Authentication and authorization is one basic prerequisite for providing IP connectivity and other services via a WLAN system
- * USIM/SIM-based authentication algorithms, plus two new EAP(Extensible Authentication Protocol) methods, EAP SIM and EAP AKA, have been specified for 3GPP-WLAN interworking.
 - EAP SIM specifies an authentication and key agreement protocol, with mutual authentication and longer session key derivation
 - EAP AKA encapsulates the UMTS Authentication and Key Agreement (AKA) within EAP. UMTS AKA natively supports mutual authentication and strong key derivation.

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WLAN Access Authentication and Authorisation (2)



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Summary

- * Interworking between 3GPP and WLAN is the demand of the market.
- * The goal of the interworking is divided into 6 different scenarios.
- * USIM/SIM-based authentication algorithms plus enhancements have been specified for 3GPP-WLAN interworking.

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Reference

- * **Interworking architecture between 3GPP and WLAN systems** *Ahmavaara, K.; Haverinen, H.; Pichna, R.*; IEEE Communications Magazine, Volume: 41, Issue: 11, Pages:74 – 81, November 2003.
- * 3GPP, "Group Services and System Aspects; 3GPP system to Wireless Local Area Network (WLAN) Interworking; System Description (Release 6)," TS 23.234 V2.4.0, Jan 2004

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Homework

- * List the main functions of 3GPP AAA Server.
- * Describe the procedure of Authentication and Authorization of the 3GPP-WLAN interworking system.

